

PCT

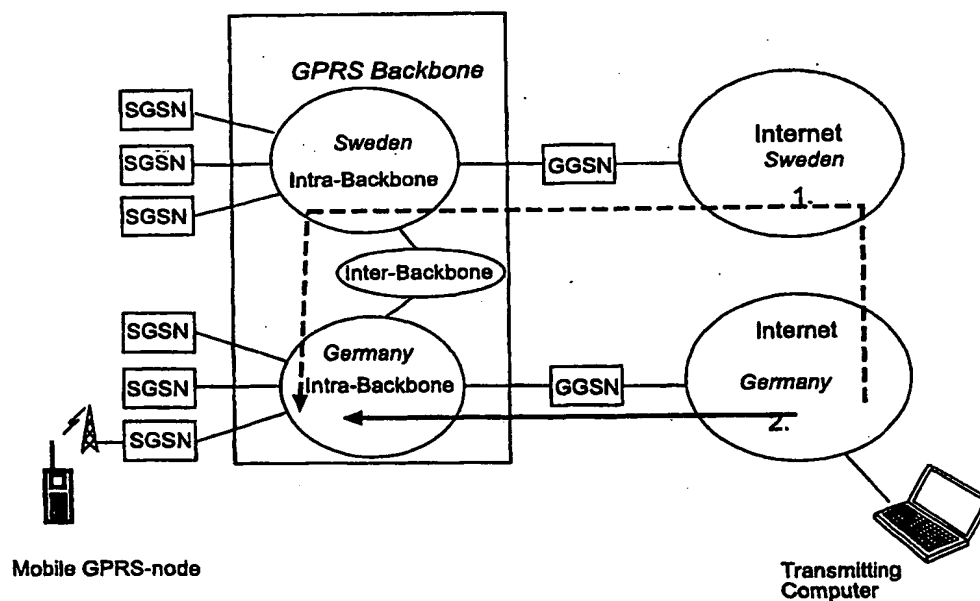
WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : H04Q 7/22	A1	(11) International Publication Number: WO 00/14981 (43) International Publication Date: 16 March 2000 (16.03.00)
(21) International Application Number: PCT/SE99/01547 (22) International Filing Date: 6 September 1999 (06.09.99) (30) Priority Data: 9803045-5 9 September 1998 (09.09.98) SE (71) Applicant (for all designated States except US): TELIA AB (publ) [SE/SE]; Mårbackagatan 11, S-123 86 Farsta (SE). (72) Inventor; and (75) Inventor/Applicant (for US only): MALMKVIST, Jonas [SE/SE]; Spelvägen 6, S-142 62 Trångsund (SE). (74) Agent: PRAGSTEN, Rolf ; Telia Research AB, Vitsandsgatan 9, S-123 86 Farsta (SE).		(81) Designated States: EE, LT, LV, NO, US , European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: PROCEDURE TO OBTAIN A COMMUNICATION ROUTE BETWEEN A TRANSMITTING COMPUTER AND A MOBILE GPRS-NODE VIA GGSN



(57) Abstract

Procedure at a digital communication network to obtain a communication route for IP-packets between a transmitting computer and a mobile GPRS-node via GGSN (Gateway GPRS Support Node). An SGSN (Service GPRS Support Node) where the mobile GPRS-node at the moment is, decides that if the IP-packets it receives are not tunnelled by GTP (GPRS Tunnelling Protocol) from an optimal GGSN, then an optimal GGSN shall be selected.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

PROCEDURE TO OBTAIN A COMMUNICATION ROUTE BETWEEN A TRANSMITTING COMPUTER AND A MOBILE GPRS-NODE VIA GGSN

TECHNICAL FIELD

The present invention relates to a procedure at a digital
5 communications network to obtain a communication route for
IP-packets between a transmitting computer and mobile GPRS-
node via GGSN (Gateway GPRS Support Node).

PRIOR ART

10 GPRS is a new telecommunications service which is
especially adapted to digital cellular networks (GSM, DECT,
PCS). GPRS makes use of the packet radio principle and can
be used to transfer data via for instance the protocols IP
and X.25 from/to a GPRS-terminal and from/to other GPRS-
15 terminals and/or external packet data networks. GPRS is
standardised in ETSI (European Telecommunication
Standardisation Institute). GPRS makes use of a packet data
technique to transmit high speed data and low speed data in
an efficient way over GSM radio networks. GPRS optimises
20 the use of network resources and radio resources. A strict
separation of the radio subsystems and the network
subsystems is obtained which results in that the network
subsystems can be reused by other radio access
technologies. GPRS does not require changes in the
25 installed MSC base stations.

GPRS consequently is a packed switched data service which
gives a mobile high speed transmission of data with
efficient use of the existing bandwidth. This is a new
30 technology in the field of GSM telephony which in optimal
cases can cope with transmission rates up to 200 kb/s (as
compared with 9,6 kb/s which GSM can cope with today). Data
transmission via GSM can be realised in two different ways:
circuit switched as in the voice transmissions of today
35 (HSCSD) or packet switched as in GPRS.

TECHNICAL PROBLEM

GPRS (General Packet Radio Service) gives a computer in global Internet the possibility to address a mobile GPRS-node with a static IP-address. The use of static IP-addresses makes it possible for a computer in global Internet to initiate a session. By standard IP-routing the IP-packets which are addressed to the static IP-address of the mobile GPRS-node to be routed to the GGSN (Gateway GPRS Support Node) which has the static IP-address in its address space. From GGSN then the IP-packets are tunnelled by GTP to the SGSN (Serving GPRS Support Node) where the mobile GPRS-node at the moment is: after that the IP-packets are transmitted to the mobile GPRS-node. This routing, however, has a number of disadvantages which the present invention can eliminate. The invention gives an optimal routing, i.e. IP-packets which are transmitted from a computer in the global Internet will be tunnelled by GTP in optimal route through GPRS backbone. The invention also solves the problems which can arise with bottle-necks both in Internet and GPRS Backbone when all traffic addressed to a node is forwarded through the same point (GGSN).

TECHNICAL SOLUTION

The technical solution is described in what is stated in the patent claims.

ADVANTAGES

By the present invention the public telecommunications network will be improved.

The invention is intended to be used in connection with GPRS and will by that be usable for both GSM and future mobile telephone systems as well as Internet.

The invention results in a better utilisation of existing network resources and by that more stable transmission

times between transmitting and receiving units by a more optimal routing in the Internet. Further the invention aims at optimising the route through GPRS-backbone. The invention also gives the system better performance and a more stable performance.

DESCRIPTION OF FIGURES

Figure 1 shows a schematic drawing of the system solution according to the invention.

10

DESCRIPTION

A list of the used abbreviations is shown below to facilitate the understanding of the invention.

15

BSS	Base Sub System
CN	Core Network
20 ETSI	European Telecommunication Standardisation Institute
GGSN	Gateway GPRS Support Node
25 GPRS	General Packet Radio Service
GTP	GPRS Tunnelling Protocol
GSM	Global System for Mobile Communication
30 HLR	Home Location Register
IP	Internet Protocol
35 MS	Mobile Station

MSC Mobile Services Switching Centre

PLMN Public Land Mobile Network

5 SGSN Service GPRS Support Node

Figure 1 describes a system where a transmitting computer in global Internet transmits IP-packets to a mobile GPRS-node which is in a GPRS-network. Reference designation 1
10 shows the route according to known technology, and reference designation 2 shows the route according to the invention.

GPRS introduces two new network nodes in the PLMN of the
15 GSM. It is the Serving GPRS Support Node (SGSN), which is on the same hierarchical level as MSC and which checks the individual MSs as to position and performs security functions and access control. SGSN can be connected to the base stations by Frame Relay.

20 Gateway GSN (GGSN) gives possibility to co-operate with external packet switched networks and is connected with SGSNs via IP-based GPRS backbone network. HLR is equipped with GPRS subscriber information and SMS-MSCs are upgraded to support SMS transmission via SGSN.

25 The security functionality of GPRSs is equivalent to the existing GSM. SGSN executes authentication and coding procedures based on the same algorithms, keys and other criteria as in the existing GSM. In order to transmit and receive GPRS-data, MS shall activate the packet data
30 address which it wants to use. This results in that MS will be known in the belonging GGSN and co-operation with external data networks can start.

User data are transferred transparently between MS and external data networks by a method known as "encapsulation"
35 and "tunnelling": the data packets are equipped with GPRS-

specific protocol information and are transferred between MS and GGSN.

When the mobile GPRS-node has a static IP-address which
5 belongs to the address space in GGSN in Sweden and at the moment is in an Intra-backbone in Germany, the following will happen at communication between transmitting computer and mobile GPRS-node.

IP-packets which are transmitted from a computer in the
10 global Internet in Germany to the static IP-address of the mobile GPRS-node will be routed to the GGSN of the mobile GPRS-node in Sweden and then tunnelled by GTP through GPRS backbone to SGSN in Germany according to the at present established technology.

15 The dashed line (1) shows the normal route which IP-packets are routed from a transmitting computer in Germany to a mobile GPRS-node in Germany. As will be evident from the Figure, this transport is not very good because the transport distance will be long. This then is an example of
20 the routing path which IP-packets are routed according to the technology of today.

By implementing a function in SGSN which implies that the packets are routed according to a procedure which means that if the SGSN where the mobile GPRS-node at the moment
25 is decides that IP-packets which it receives are not tunnelled by GTP from an optimal GGSN, an optimal GGSN shall be selected.

Below follows a detailed description of the procedure:

- 30 1. In SGSN there is a list over which GGSNs that are suitable to communicate with. When SGSN receives an IP-packet which is tunnelled by GTP from normal GGSN, SGSN inquires whether there is any optimal GGSN. Selection of optimal GGSN is based on from where the IP-packets are
35 transmitted, i.e. the transmitter address in the head of the IP-packet, and the list over GGSNs which are

suitable to communicate with. An optimal GGSN is selected.

2. A message is transmitted to optimal GGSN with the content to create an association between the static IP-address of the mobile GPRS-node and the SGSN where the mobile GPRS-node at the moment is. The result will be that IP-packets addressed to the static IP-address of the mobile GPRS-node which are received at optimal GGSN will be tunnelled by GTP to the temporary SGSN.
3. SGSN awaits a confirmation from optimal GGSN that an association is created between the static IP-address of the mobile GPRS-node and the temporary SGSN.
4. Optimal GGSN transmits a confirmation to SGSN that an association is created between the static IP-address of the mobile GPRS-node and the temporary SGSN.
5. SGSN after that transmits a message to the transmitting computer in global Internet with the content that IP-packets addressed to the static IP-address of the mobile GPRS-node shall be encapsulated and tunnelled to the to the IP-address belonging optimal GGSN.
6. IP-packets addressed to the static IP-address of the mobile GPRS-node now will be tunnelled to optimal GGSN where the IP-packet is decapsulated, i.e. IP-packets will regain their original form. After that the IP-packets are tunnelled by GTP to the SGSN where the mobile GPRS-node at the moment is.
7. If the mobile GPRS-node changes SGSN while the session is in progress, the association is updated in optimal GGSN with the new SGSN. IP-packets which already have been transmitted to the previous SGSN are transmitted from the old SGSN to the new SGSN.

In the transmitting computer there is support for encapsulation of IP-packets, and support to manage

- associations between the static IP-address of the mobile GPRS-node and optimal GGSN. In GGSN there is support for

decapsulation of IP-packets and support to manage associations between the static IP-address of the mobile GPRS-node and the temporary SGSN.

- 5 The association between the normal GGSN and the temporary SGSN is updated all the time to make it possible for other users to start new sessions. If the transmitting computer does not have support for encapsulation of IP-packets, or does not have support to manage associations between the
10 static IP-address of the mobile GPRS-node and optimal GGSN, the normal route always can be used.

The continuous line (2) shows the optimal route which is achieved by use of the procedure according to the
15 invention, at which IP-packets are routed from a transmitting computer in Germany to a mobile GPRS-node in Germany.

The invention is not limited to the above illustrated
20 example, but can be modified within the idea of the invention as it is defined in the patent claims.

PATENT CLAIMS

1. Procedure at a digital communication network to obtain a communication route for IP-packets between a transmitting
5 computer and mobile GPRS-node via GGSN (Gateway GPRS Support Node), characterised in that an SGSN (Service GPRS Support Node), where the mobile GPRS-node at the moment is, decides that if IP-packets it receives are not tunnelled by GTP (GPRS Tunnelling Protocol) from
10 an optimal GGSN, then an optimal GGSN shall be selected.
2. Procedure according to patent claim 1, characterised in that the decision is made via a device in SGSN which includes a function to route
15 IP-packets.
3. Procedure according to patent claim 2, characterised in that in SGSN there is information about which GGSNs that are suitable to
20 communicate with, and when SGSN receives an IP-packet which is tunnelled by GTP from the normal GGSN, then SGSN inquires if there is any optimal GGSN, at which optimal GGSN is based on from where the IP-packets are transmitted, i.e. the transmitter address in the head of the IP-packet,
25 and the information over GGSNs which are suitable to communicate with, at which an optimal GGSN is selected.
4. Procedure according to patent claim 3, characterised in that a message is transmitted
30 to optimal GGSN with the content to create an association between the static IP-address of the mobile GPRS-node and the SGSN where the mobile GPRS-node at the moment is, at which IP-packets addressed to the static IP-address of the mobile GPRS-node which are received at optimal GGSN will be
35 tunnelled by GTP to the temporary SGSN.

5. Procedure according to patent claim 4,
c h a r a c t e r i s e d in that SGSN awaits a
confirmation from optimal GGSN that an association is
created between the static IP-address of the mobile GPRS-
5 node and the temporary SGSN.

6. Procedure according to patent claim 5,
c h a r a c t e r i s e d in that optimal GGSN transmits a
confirmation to SGSN that an association is created between
10 the static IP-address of the mobile GPRS-node and the
temporary SGSN.

7. Procedure according to patent claim 6,
c h a r a c t e r i s e d in that SGSN transmits a message
15 to the transmitting computer in global Internet with the
content that IP-packets addressed to the static IP-address
of the mobile GPRS-node shall be encapsulated and tunnelled
to, to the IP-address belonging, optimal GGSN.

20 8. Procedure according to patent claim 7,
c h a r a c t e r i s e d in that if the mobile GPRS-node
changes SGSN during session in progress, the association is
updated in optimal GGSN with the new SGSN at which IP-
packets which already have been transmitted to the previous
25 SGSN are transmitted from the old SGSN to the new SGSN.

9. Procedure according to patent claim 8,
c h a r a c t e r i s e d in that in the transmitting
computer there is support for encapsulation of IP-packets,
30 and support to manage associations between the static IP-
address of the mobile GPRS-node and optimal GGSN, and in
GGSN there is support for decapsulation of IP-packets and
support to manage associations between the static IP-
address of the mobile GPRS-node and the temporary SGSN.

1/1

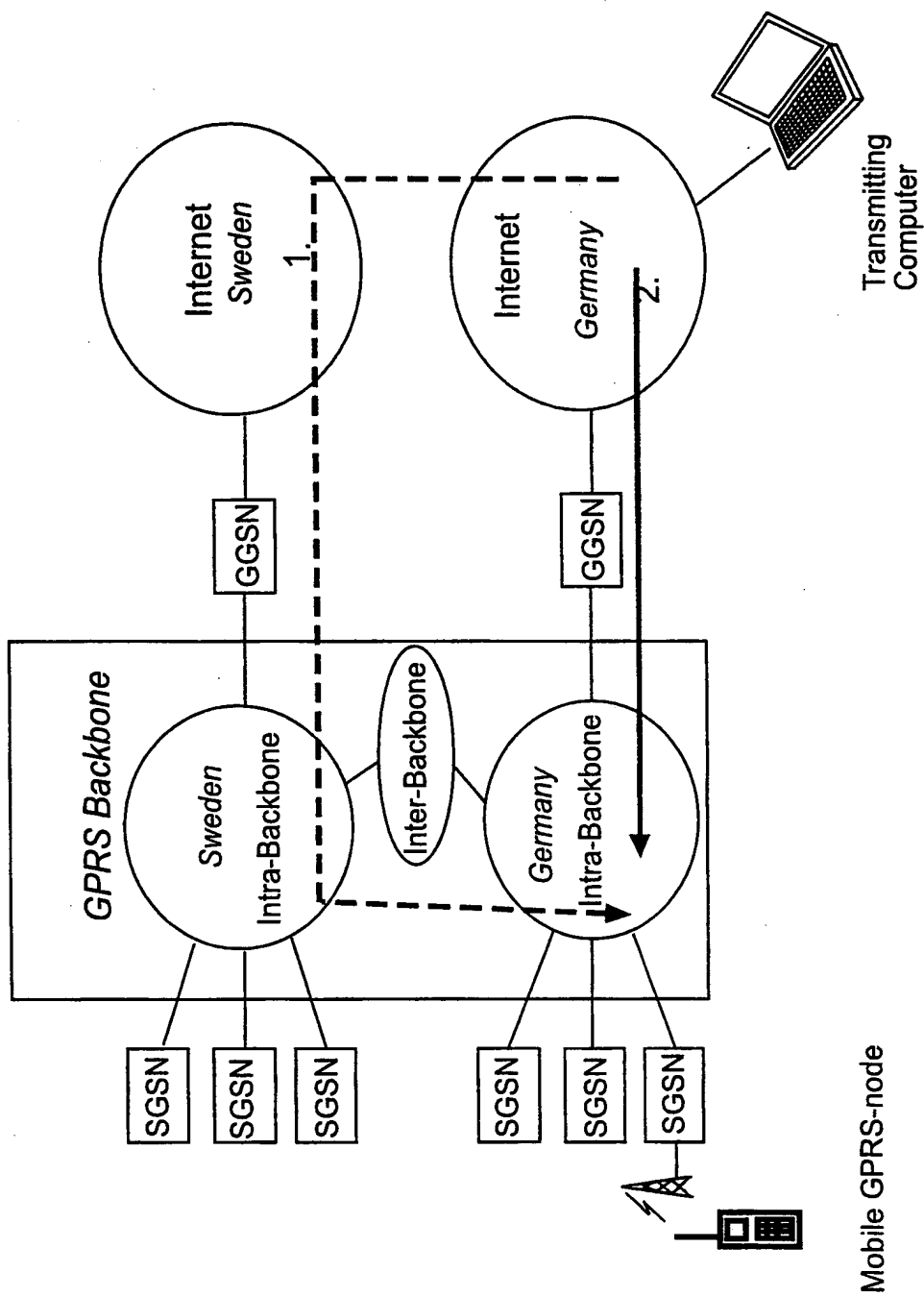


Figure 1

1
INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/01547

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9748246 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 18 December 1997 (18.12.97), page 6, line 15 - page 8, line 18 --	1-9
P,A	WO 9859468 A2 (NOKIA TELECOMMUNICATIONS OY), 30 December 1998 (30.12.98), page 6, line 7 - line 22 --	1-9
A	IEEE Communications Magazine, Volume, August 1997, Götz Brasche et al, "Concepts, Services, and Protocols of the New GSM Phase 2+ General Packet Radio Service" page 97 - page 98 --	1-9

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "B" earlier document but published on or after the international filing date
- "I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

14 February 2000

Date of mailing of the international search report

17-02-2000

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM

Authorized officer

Jaana Raivio/cs

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/01547

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0859531 A2 (TELEFONAKTIEBOLAGET LM ERICSSON), 2 January 1998 (02.01.98), abstract --	1
A	US 5325362 A (ASHAR AZIZ), 28 June 1994 (28.06.94), abstract -- -----	1

INTERNATIONAL SEARCH REPORT
Information on patent family members

02/12/99

International application No.
PCT/SE 99/01547

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	9748246	A1	18/12/97	AU	3199797 A	07/01/98
				CA	2257981 A	18/12/97
				CN	1228228 A	08/09/99
				EP	0904665 A	31/03/99
				US	5708655 A	13/01/98
WO	9859468	A2	30/12/98	AU	7920998 A	04/01/99
				EP	0920761 A	09/06/99
				FI	972725 A	25/12/98
EP	0859531	A2	02/01/98	AU	6225898 A	07/08/98
				NO	970181 A	16/07/98
				WO	9832305 A	23/07/98
				ZA	9800074 A	08/07/98
US	5325362	A	28/06/94	EP	0655847 A	31/05/95
				JP	7170286 A	04/07/95

THIS PAGE BLANK (USPTO)